Comments on Petition for rulemaking by Mark Miller, N5RFX

This comment respectively submitted by Gerald F. (Rick) Muething, KN6KB, AAA9WK

Mr. Millers's petition for rulemaking contains numerous errors and misinterpretations and appears to be targeted specifically for one specific mode (Pactor III) and one specific amateur message service (Winlink 2000). Why Mr. Miller seeks to specifically target specific modes or services is unclear from his petition but such targeting is neither legal nor appropriate for any rulemaking proposed by the FCC.

Specifically I will address several points in Mr. Miller's petition and augment my comments with other knowledge and experience I have attained in my over 40 years as an amateur radio operator. I also hold a Masters degree in Electronic Engineering (Communications and computer science) and have extensive professional experience in programming including digital radio client/server development and digital signal processing (DSP) programming.

1) Re: Mr. Miller's comment. "Pactor III is designed specifically for the commercial market"

This comment is not true and not supported by any historical facts. Pactor III (and Pactor II and Pactor I) were designed by Radio amateurs at SCS (Germany). Pactor I was released to the public domain and used by several Amateur modem manufactures. Pactor II and III are and have been used by the amateur radio community world wide for many years primarily because these modes offer the best available performance (robustness and throughput) of any available "error free" digital protocol. The basic modulation mechanisms of Pactor II and III (OFDM, multi carrier PSK modulation) are well understood by those familiar with the digital modulation and are *not* proprietary. Only the specific implementation and protocol of Pactor II and III are proprietary to SCS and are what is licensed by their modems and firmware. Pactor III was designed to comply with the US Amateur maximum symbol rate (now considered an obsolete/unnecessary regulation). Pactor III is used in some commercial applications (as is Pactor I and II and other amateur protocols) but the product and protocol was not designed specifically for commercial applications. Any commercial manufacturer or amateur is free to design, implement and deploy (for free in the public domain or for profit) a hardware or software modem based on the same basic modulation principals as Pactor II and III. The primary reasons

there is not significant amateur competition to the SCS PTC II modem center around the following issues:

1) The total available world-wide market for such products is limited…especially compared to consumer or military products.

2) There is significant skill level and experience needed to implement such products (a high technical barrier to entry). Designing, implementing, deploying and supporting these modems is a specialized skill.

3) There is considerable uncertainty with respect to US amateur laws (symbol rate limitation, segmentation by bandwidth or operating mode, automated/semiautomatic operation, available frequencies, etc) Without the sizeable US market there is little incentive for companies or ham experimenters to invest in this type of product development.

2) Re Mr. Millers statement: " The analysis consisted of sending data between two PTC II modems through PathSim a PC Sound card channel emulator"

Is incorrect. I personally performed the measurements based an a hardware channels simulator and Mr. Miller has no details of specifically how the measurements were made, what the power level, crest factor or bandwidth levels used were. He made no attempt to contact me with questions or clarifications about the tests and included only my summary document that was part of a presentation at ARRL/TAPR DCC 2004. Mr. Miller provided no new or original information sighting only the work of others and selecting or extracting (sometimes out of context) only data that he could present or manipulate to fit his specific objective of limiting Pactor III and semi automatic operation. While it may not have been intentional it is interesting that the performance curve of Pactor III in one of my slides (my power point presentation attached) seems to have been lost in the scan to his pdf document as presented on the FCC web page.

3) Re Mr. Millers statement: "During optimal conditions the bandwidth (of Pactor III) increases from 500Hz to 2.2 KHz without determining if the wider spectrum is occupied"

Is incorrect. Pactor III's bandwidth is 1000 to 2200 Hz from speed level 1 – 6. In normal operation (with the exception of extremely low S/N or very poor multipath) Pactor III operates in speed levels 3 – 6 occupying a bandwidth of 1720 – 2000 Hz. In at least the Winlink system of US stations there are *no* situations where Pactor III and other Pactor levels are used on the same frequencies. Any attempt to connect to a Pactor III server using Pactor II or Pactor I is immediately (< 5 seconds) disconnected. Therefore all Pactor III frequencies used in the US by the Winlink system *always* operate between

1000 and 2200 Hz bandwidth and usually between 1720 and 2200 Hz under most propagation conditions.

4) Re. Mr. Millers statement: "To date there have been no technical innovations to minimize interference"

Is incorrect. Specifically the current firmware in the SCS PTC II class modem includes an effective DSP based busy detector that can detect Pactor activity in the channel to low S/N levels. This detector is not perfect (just as the human ear is not perfect in detecting signals at low S/N levels) but it is useful and effective. This "busy detector" is currently used both in clients and server programs (e.g. AirMail, Paclink MP, etc) that use Pactor II and III to reduce the chance of interference to existing Pactor sessions on the same (or near) frequencies.

There have also been promising DSP approaches to busy channel detection made and documented by myself and others based on PC sound card and PC based DSP technology. Such detectors show promise in detecting numerous modulation schemes (CW, SSB Voice, MT63, Pactor, PSK31, RTTY etc). While these detectors will never be perfect especially with high data entropy signals (which sound much like noise) and very low S/N levels they will be able to offer detection levels approaching and at times exceeding a skilled operator in similar conditions. The regulations and band plan should encourage the continued development, refinement and advancement of such technology both for digital data and digital/analog voice operation.

Despite much rhetoric to the contrary the majority of interference stems from two poor operating practices of a some digital users.

One poor operating practice involves using a client to manually initiate a call to another (automatic answering) station without carefully listening for a open channel (or subverting the busy detector). One only has to listen to the SSB phone bands to know this poor practice is not limited to digital transmissions. In semi automatic systems the automated end of the link *NEVER* initiates a call and responds only after it receives and successfully decodes a connect request. While interference can be caused from the automated station when there is a hidden transmitter (the manual station *cannot* hear a third station when the third station *can* hear the automated station) this is a relatively infrequent condition.

The second poor operating practice that results in interference is the use of wide band (panoramic) receivers (usually using sound card and DSP technology) to operate with narrow band modes. Such practices subvert the benefits of narrow band modes by operating the receivers "wide open" which

results in un necessary interference when adjacent (but non overlapping) interfering signals exist in the wide pass band. Simply narrowing the receiver bandwidth to a value consistent with the narrow band mode would significantly reduce much of this type of "interference".

I also offer the following observations and suggestions:

1) Many countries now use modernized amateur rules that do not attempt to legislate emissions by signal type or content. These modernized rules promote experimentation, development and healthy competition. Rather than complex and quickly out-of-date rules these countries support a more flexible band plan such as those adopted or proposed by the IARU. Adopting band plans and minimizing technical regulations by mode, content or bandwidth will provide a flexible framework that promotes innovation, competition and minimizes interference without using cumbersome rulemaking procedures which too quickly become obsolete. One only has to look at the current US regulation of the 300 baud symbol rate limitation for an example of an ill formed and technically obsolete rule is still in the regulations nearly 20 years since its adaptation.

2) There are now several HF digital modes (existing and emerging) that use wide band (to 2.7 KHz) bandwidth. These include. MT63, Olivia, Domino, ALE, DRM, RDFT and several others. In addition there are existing modems (both hardware and now PC sound card software) that *could* be used effectively and inexpensively if the obsolete 300 baud symbol rate limitation were dropped. These include standardized high performance HF modems like STANAG, MARS-ALE among others. These modems and modulation schemes can be used for transmission of binary data, text, image (digital image), and digital voice. Specifically existing rules such as the obsolete 300 baud symbol rule and the rules that treat images, digital images, digital voice and data as separate emission types should be removed from the regulations. They do not encourage good and efficient band usage and they significantly discourage experimentation and market development of new technology. The often heard phrase in amateur product development circles is …."Why should we develop a better modem or protocol when there is no regulation that permits it or allocates spectrum for it?"

3) The existing automatic forwarding sub bands were intended originally to allow fully automated (unattended at BOTH the initiating and receiving stations) data forwarding primarily used by HF Packet and AMTOR. There is very limited use of this type of operation today.

Today most digital message systems use a smart client program (that allows a user to compose a message, make a connection request to a remote

automated station, and transfer the message automatically with minimum air time conserving spectrum). These clients (with the use of existing channel busy detection and good operating practice) eliminate most interference. What I believe should be done is to modernize the existing auto forwarding sub bands to distinguish fully automated forwarding from manually initiated forwarding (often called semi automatic) and to segment these forwarding modes by sub band. The sub bands can then segregate these emissions from all-manual or narrow band modes. However practical and efficient use of these sub bands requires that they be large enough (by regulation or preferably by band plan) to accommodate the anticipated usage. An glaring example of an inadequate sub band allocation is the current 5KHz permitted on 40 meters (7100 – 7105KHz)

There is no question that modernization of the current regulations is needed. And while there will always be those that wish for no change or the return of "yester year" our amateur history is one of experimentation and innovation. We *need* a well thought out and minimal set of regulations that can be flexible and accommodate innovations in technology and the continually changing activities of today's multi faceted amateur radio community. We do *not need* to rule out or restrict specific modulation modes, modem manufacturers or amateur services just because they do not agree with someone's limited perspective on "what is right" or "what is best".

Respectively submitted,

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